Journal of Medicinal Plants Studies
www.PlantsJournal.com

ISSN (E): 2320-3862
ISSN (P): 2394-0530
NAAS Rating 2017: 3.53
JMPS 2017; 5(3): 269-272

Received: 13-03-2017
Accepted: 14-04-2017

Ashish Kumar
CSIR-Central Institute of Medicinal and Aromatic Plants - Research Centre, Boduppal, Hyderabad, Telangana, India

Jnanesha AC
CSIR-Central Institute of Medicinal and Aromatic Plants - Research Centre, Boduppal, Hyderabad, Telangana, India

Correspondence
Ashish Kumar
CSIR-Central Institute of Medicinal and Aromatic Plants - Research Centre, Boduppal, Hyderabad, Telangana, India

Potential species of aromatic plants for cultivation in semi-arid tropical (Sat) regions of Deccan region

Ashish Kumar and Jnanesha AC

Abstract
The Deccan or southern region of India has varying soil types and agro-climatic conditions, which offers tremendous scope for cultivation of Aromatic plants. The regions like, Western Ghats, Eastern Ghats and Vindhya and Satpura ranges as its western, eastern and northern boundaries. Godavari, Krishna, Cauvery, Tungabhadra, Narmada and Tapti are the major rivers. The region experiences semi-arid to tropical climate with south-west and north-east monsoons as the main rainy seasons. There is an ever increasing demand of natural-food, pharmaceutical, perfumery, flavours and cosmetic products based on aromatic plants. The region is globally known for its sandalwood (*Santalum album* L., Santalaceae) and red sanders (*Pterocarpus santalinus* L., Fabaceae) reserves. A commercially important Aromatic plants cultivated in this regions are Lemongrass (*Cymbopogon flexuous*), Citronella java (*Cymbopogon winterianus*), Palmarosa (*Cymbopogon martini*), French (sweet) basil(*Ocimum basilicum*), Holy (sacred) basil*(Ocimum sanctum/tenuifiorum*), Rose-scented geranium (*Pelargonium graveolens*), Vetiver (*Vetiveria zizanioides*), Pachouli (*Pogostemon patchouli*), Lemon-scented Gum (*Eucalyptus citriodora*), Menthol mint ((*Mentha arvensis*), Davana (*Artemisia pallens*), African marigold (*Tagetes minuta*) and blue gum (*Eucalyptus globulus*) etc. are cultivated by the farmers of the region.

Keywords: Deccan region, aromatic plant species and cultivation.

1. Introduction
The occurrence of essential oils, or volatile oils, is very widespread in the plant kingdom. As their second name implies, they are volatile in steam. They are accumulated in oil cells, in secretion ducts or cavities or in granular hairs of plants. Plants bearing essential oils were known, or even utilized in religious ceremonies or for personal use, adornment and flavoring foods long before recorded history. In India hundreds of aromatic substances including cinnamon, ginger and sandalwood were recorded in Vedic literature around 2000 BC. The state has semi-topical climate with hot summers and relatively pleasant winters, especially on the interior plateaus. The coastal strip has humid to semi-hum conditions. The state receives rainfall mainly from the South-West monsoon (69%), North-East monsoon (22%) and during winter and hot weather months (9%). The average annual rainfall ranges from 650 mm in the semi-arid belt (Rayalseema) to 1100-1300 mm in the North Eastern portion of the state (coastal Andhra and north of Godavari River). Coastal Andhra is affected by storms during May and storms depression and cyclones during September-November. In September-November, floods are likely to occur due to excessive and localized rains. During the North-East monsoon season, 2 or 3 depressions occur any one of which may attain severe storm intensity. These storms result in widespread and heavy rains in the coastal region, adversely affecting crops, particularly the rice harvest and sometimes completely destroying the crop. The predominant soils of the state are red soils (65% black soils (25%) and alluvial soils (5%). The remaining 5% soils are coastal sands laterite and lateritic soils and problem soils. The temperatures during summer months of March to June cross 40 ^{0}C in many parts of the region. The region is agriculturally prosperous with agricultural, horticultural, spice and commercial crops under large scale cultivation. There are over 1300 species of essential oil bearing plants, aromatic plants form a part of their aromatic value. At present 24 species are cultivated commercially. Deccan Plateau Region contributes about 30% of the Indian essential oil export. The growing demand of essential oil is putting a pressure on the existing resources owning to limitation on the existing sources and threatened natural habitats; cultivation of aromatic plant is inevitable.

Aromatic Plants Products demand

Aromatic (Aroma Producing) plants are those plants which produce a certain type of aroma. Their aroma is due to the presence of some kind of essential oil with chemical constituents that contain at least one benzene ring in the their chemical configuration. The chemical nature of these aromatic substances may be due to a variety of complex chemical compounds. These plants have made a good contribution to the development of ancient Indian material medics. In recent years, there has been a tremendous growth of interest in plant based drugs, pharmaceuticals, perfumery products, cosmetics and aroma compounds used in food flavors and fragrances and natural colors in the world. There is a definite trend to adopt plant based products due to the cumulative derogatory effects resulting from the use of antibiotic and synthetics and except for a few cultivated crops, the availability of plant based material is mainly from the natural sources like forests and wastelands. There is a need to introduce these crops into the cropping system of the county, which, besides meeting the demands of the industry, will also help to maintain the standards on quality, potency and chemical composition. During the past decade, demand for aromatic plants and its products has attracted the worldwide interest, India being the treasure house of biodiversity, accounts for thousands of species which are used in herbal drugs.

The demand for natural aroma chemicals is increasing rapidly the world over with increasing population and growing awareness. At present, India with 1.1% share, occupies a leading position in the global trade of essential oils. South India contributes 30 % to the total export of aroma chemicals from India. Deccan Region being endowed with varying soil and climatic conditions is designated as the home of spices and several essential oil bearing crops. India is a traditional exporter of essential oils like sandalwood, lemongrass, palma rosa and spices etc. Of late, India has diversified its activities producing exotic oils like citronella Java, mints oils etc. and exporting oleoresins of spices, concretes and absolutes of flowers.

Aromatic Plants cultivated in the Deccan region

The following Aromatic plants are commercially cultivated in this region: Lemongrass (*Cymbopogon flexuous*), Citronella java (*Cymbopogon winterianus*), Palma rosa (*Cymbopogon martini*), French (sweet) basil(*Ocimum basilicum*), Holy (sacred) basil (*Ocimum sanctum/tenuifiorum*), Rose-scented geranium (*Pelargonium graveolens*), Vetiver (*Vetiveria zizanioides*), Pachouli (*Pogostemon patchouli*), Lemon-scented Gum (*Eucalyptus citriodora*), Menthol mint ((*Mentha arvensis*), Davana (*Artemisia pallens*), African marigold (*Tagetes minuta*), Wormwood (*Artemisia annua*), Campher tree (*Cinnamomum camphora*),aromatic ginger (*Kaempferia galangal*), blue gum (*Eucalyptus globulus*), sandalwood (*Santalum album*) and red sanders (*Pterocarpus santalinu*) etc. Many more Aromatic Plants can be cultivated in this region to supply Essential oil on a sustainable basis to national and international perfumery markets.

Sources of Aromatic Plants Products

Essential oils are generally derived from one or more plant parts, such as flowers (e.g. rose, jasmine, carnation, clove, mimosa, rosemary, lavander), leaves (e.g. mint, Ocimum spp., lemongrass, jamrosa), leaves and stems (e.g. geranium, patchouli, petit grain, verbena, cinnamon), bark (e.g. cinnamon, cassia, canella), wood (e.g. cedar, sandal, pine), roots (e.g. angelica, sassafras, vetiver, Saussure, valerian), seeds (e.g. fennel, coriander, caraway, dill, nutmeg), fruits (bergamot, orange, lemon, juniper), rhizomes (e.g. ginger, calamus, curcuma, orris) and gums or oleoresin exudations (e.g. balsam of Peru, balsam of Tolu, storax, myrrh, benzoin).

Aromatic Plants Products

The demand for different aromatic plants products is not unlimited and varies from year to year; therefore cultivated area under each crop is to be monitored not to exceed the demand. Competition from cheaper synthetic chemicals is still a factor to be considered. The cost of cultivation and production are to be brought down to the maximum possible extent so as to make the natural products commercially competitive to syntactic chemicals. Another problem in marketing is irregular supplies of adulterated or inferior quality products at higher prices which make the industries to look for alternatives like cheaper synthetic chemicals. Reliability is a key factor for successful marketing of these products. Industries would prefer naturals to synthetics, if the supplies of these products are regular, in sufficient quantities, conforming to international quality standards and reasonably priced. Prices of some aromatic plant products are set out in Table 1.

Table 1: Prices of some of the aromatic plant products

S. NO.	Products	□ INR/Kg.	S. No.	Products	□ INR/Kg.
1.	Citronella herb oil	1000-1200	5.	French/sweet basil oil	800-1000
2.	Davana herb oil	45000-50000	6.	Rose-scented geranium oil	10000-11000
3.	Lemongrass herb oil	1000-1200	7.	Palmarosa herb oil	1200-1500
4.	Lemon-scented Gum oil	1200-1400	8.	Vetiver root oil	15000-20000

Requirements and Evaluation Criteria

Farmers and entrepreneurs who wish to cultivate or start an enterprise based on Aromatic Plants are advised to carefully consider the following points:

- The information on soil condition and site on water logging, industrial waste and effluents.
- Collect complete information about the Aromatic plants intended for cultivation: Central and State Government organizations/ Departments, cultivating farmers provide the desired information.
- There should be sufficient source of irrigation water.
- Survey the market and satisfy yourself concerning marketing opportunities and future demand.
- Procure good planting material/seed from authentic sources.
- Information of type of seed used and agronomic practices applied should be available
- Arrange for funds through self-investment, loans, subsidies etc.
- Ensure periodical supervision of the work force in case of absent landlordism particularly at inputs application (fertilizers/ manures, other chemicals) time and when engaging many workers for weeding, harvesting etc.
- Proper drying techniques and technology be adopted for

drying and storage of harvested Aromatic plant material/oil.

- Apply inputs (manures, fertilizers, irrigation) at appropriate time.
- Test the quality of the produce before marketing.
- Market as soon as possible. Improper post-harvest handling and storing reduces shelf-life and quality of the produce.

Agronomic Profiles of Aromatic Plants Species in the Deccan Region

Aromatic plants possess odorous volatile substances which occur as essential oil, gum exudate, balsam and oleoresin in one or more parts, namely, root, wood, bark, stem, foliage, flower seed and fruit. The characteristic aroma is due to a variety of complex chemical compounds. The term essential oil is similar to fragrance or perfumes because these fragrances are oily in nature and they represent the essence or the active constituents of the plants.Essential oils and aroma chemicals constitute a major group of industrial products. They are adjuncts of cosmetics, soaps, pharmaceuticals, perfumery, confectionery, ice-creams, aerated waters, disinfectants, tobacco products, incense sticks and a host of related products.

Table 2: Important Aromatic Plants Species and Their Cultivation Practices.

Trade Name/Scientific Name, Family	Commercial Application	Propagation Method	Agriculture practices
Citronella java/*Cymbopogon winterianus*/Poaceae	Oil obtained from steam distillation of leaves in rich in citronellal and geranial and is used in perfumery, cosmetics and mosquito repellent formulations.	Vegetatively through slips during July/August and Feb/March, about 55,000 slips/ha	Irrigation: 4-6 during rain free period, fertilizer: 150 N, 60P_2O_5 and 60K_2O kg/ha/year. Leaf blade is harvested 15 cm above the ground. First harvest comes 90 days after planting, subs equently at 3-4 months interval; economic life 4 Year
Lemon-scentedgum/*Eucalyptus citriodora*/Martaceae	The oil is used in soaps, perfumes, disinfectants, germicides and for exaction of citronellal which is used in midmarket washing and washing-up detergents.	The crop is raised through seeds; seedlings are first raised in polythene bags as the root system of the seedlings is sensitive. The seeds germinate in 4-15 days. They attain 20-30 cm height in about 12-16 weeks and are ready for transplanting.	Grow well in acidic to slightly alkaline deep soil, PH 5.5 to 8.5, Spacing 2×2 (Rainfed) and 75×75 (Irrigated), Fertilizers 60-120 kg. N in 2 or 3 equal splits, 30kg. Each of P_2O_5 and K_2O Per/ha. Are applied every year.
Lemongrass/*Cymbopogon flexuosus*/Poaceae	The oils used in perfumery and cosmetic industry and also in manufacture of Vitamin A.	Through vegetative slips during Feb / March, economic life: 4-5 yr.	4-5 harvests/year, 6-8 irrigation and fertilizer; N 150,6OP_2O_5, 60 K_2O, FYM 10t/ha., Harvesting period May to December
French/sweet basil/*Ocimum basilicum*/Lamiaceae	The oils are used in soaps, perfumery, flavor and pharma-ceuticalindusties and for isolation of aroma chemicals like linalool, methyl cinnamate, methyl chavicol etc.	Seeds by direct seeding or tansplanting of 6-7 week old seedlings is adopted where irrigation facilities exist	Fertile and well drained loamy soil, spacing 60×40, FYM-20 t/ha, 120kg./ha N, 80kg./ha P_2O_5 and 40kg/ha K_2O Per/ha., Irrigation weekly once, Harvesting 65-75 days after planting when the plant is in full bloom stage.
Menthol mint/*Mentha arvensis*/Lamiaceae	Oil is source of natural menthol used in flavour and pharmaceutical industries.	Vegetative propagation through suckers; 5q suckers for direct sowing and 1q/ha suckers are required for nursery and transplantation of seedlings	It is a 6-7 months crop, soil well drained fertile loamy soils, Spacing 45×45cm, Irrigation weekly one an time, Fertilizers N160, P_2O_5 50 and K_2O 40 kg/ha.,First harvest 100-120 days after planting, second harvest after another 60-70 days
Palmarosa/*Cymbopogon martinii*/Poaceae	It is used in perfumery and cosmetic industries, flavoring of tobacco and in soaps.	Propagated during rainy season through seeds 10-12 kg/ha.Seed for direct sowing and 2.5 kg/ha.Seed are required for nursery and transplantation of seedlings	Fertilizers: N 100, P_2O_5 50 kg/ha/year. In poor red soil of Deccan plateau, N up to 250 kg/ha gives good result.46 irrigation (during rain free period). The crop is harvested 3-4 months after planting; 2-3 harvests obtained in the first year and 3-4 in subsequently year. Economic life 4-6 year
Rose-scented geranium/ *Pelargonium spp.*/Geraniaceae	The eaves and branches are steam distilled to get "oil of geranium" used in high-grade perfumery product and soaps.	Through stem cutting, about 40000 plants/ha during November to February	Spacing 60×60, Irrigation Alternative days for a month; later on at 5-7 days interval, fertilizer: 150-200 kg N, 60 P_2O_5 and 60 K_2O kg/ha., 2-3 weeding and regular hoeing are required, Harvest after about 4-5 months
Vetiver/*Vetiveria zizanioides*/Poaceae	The roots are steam distilled to get vetiver oil, which used in high-grade perfumers.	Vegetatively through slips; planting during February and July-August; 40,000 slips/ha.	Roots are harvested 18-10 months after planting. Soils of medium fertility do not require fertilizer. For red laterite soils in South India, fertilizer N20, $P_2O_5$40 kg/ha is required as basal dose at the time of planting. Vetiver is cultivated as a rain fed crop; 1-2 irrigation: required if planted during dry period.

Table 3: Productivity of essential oil yielding crops in the Deccan region

Crop	Herb Yield (tonnes/ha)	Oil Content (%)	Oil Yield (Kg/ha)
Citronella java	35-40	0.6-1.0	200-260
Lemon-scented gum	15-20	0.5-1.0	120-150
Lemon Grass	30-35	0.5-0.8	170-220
French/sweet basil	15-20	0.1-0.25	25-35
Menthol mint	35-45	0.5-0.7	150-220
Palmarosa	35-40	0.5-0.6	200-250
Rose-scented geranium	30-45	0.6-0.1	30-50
Vetiver	1-2	0.8-1.0	10-20

Conclusions

The Deccan region comprises 9 states of India and is rich in Aromatic Plants diversity. A number of Aromatic Plants are cultivated, processed and marketed in different states in this region. Several more Aromatic Plants can be grown and traded. Aromatic Plants cultivated and potential Aromatic Plants with high demand that can be grown have been listed. With increasing national and global demand for Aromatic Plants, there is excellent scope for cultivating many Aromatic Plants in this region. In India and world markets, demand for aromatic plant materials is increasing & going to increase in future. Current and future changes in lifestyles, increased Health awareness, and familiarity with plant products through media and scientific reports, can be expected to bring more & more people to using aromatic plants products.

References

1. Husain A. Some recent development in improvement of agro technology of essential oil crops in India. Proceeding xi International Congress of Essential Oils, Flavours and Fragmnces held at New Delhi, India. 1989; 2:41-46.
2. Adilson Sartoratto, Ana Lúcia M, Machado, Camila Delarmelina, Glyn Mara Figueira, Marta Cristina Duarte T, Vera Lúcia Rehder G. Composition and Antimicrobial Activity of Essential Oils from Aromatic Plants Used In Brazil. Brazilian Journal of Microbiology. 2004; 35:275-280.
3. Nitin Rai, Lalit Tiwari, Rajeev Kumar Sharma. Agronomic Practices for High Trade Value Indian Aromatic Plants. International Journal of Advanced Agricultural Science and Technology. 2012; 1(1):1-11.
4. Rajeswara Rao BR, Syamasundar KV, Rajput DK, Nagaraju G, Adinarayana G. Potential Species of Medicinal Plants for Cultivation in Deccan Region. Journalof Pharmacognosy. 2012; 3(2):96-100.